

The purpose of this guide is to provide a range of knowledge at which students can demonstrate proficiency for each objective. Subsequent college course success depends strongly on courses taught primarily at the “some applied skills demonstrated” and “applied skills strongly demonstrated” levels.

<b>TAG Learning Outcomes</b>	<b>Applied skills strongly demonstrated</b>	<b>Some applied skills demonstrated</b>	<b>Little applied skills demonstrated</b>	<b>No applied skills demonstrated</b>
1. Demonstrate an understanding and working knowledge of semiconductor properties.*	<ul style="list-style-type: none"> <li>Construct voltage, electrical field, and energy diagrams of the pn-junction as a function of applied bias.</li> <li>Describe the relationship between drift and diffusion currents in a pn junction.</li> </ul>	<ul style="list-style-type: none"> <li>Determine the effect of applied bias on the width of the depletion region.</li> <li>Illustrate carrier concentrations in all regions of a pn junction under applied bias.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the physical basis for the depletion region.</li> <li>Demonstrate knowledge of the barrier potential levels of common silicon and germanium pn-junctions.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the difference between conductors, insulators, and semiconductors.</li> <li>Identify the difference between majority and minority carriers in p-type and n-type materials.</li> </ul>
2. Identify common and special purpose diode types and their operations. Utilize diodes and special purpose diodes in an electrical circuit.*	<ul style="list-style-type: none"> <li>Construct and analyze common diode circuits such as limiters, clampers, and voltage doublers.</li> <li>Calculate the minimum load that can be regulated in a Zener circuit, given parameters attained on data sheets.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate theoretically and experimentally how a diode rectifies an AC signal.</li> <li>Calculate the maximum and minimum input voltages that can be regulated by a given Zener diode.</li> <li>Utilize light emitting diodes (LEDs) in circuits as voltage indicators.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate the ability to identify the cathode and anode of a common diode using a multimeter.</li> <li>Describe and illustrate the differences between common and Zener diodes, including critical voltage and current parameters.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate the ability to visually identify the cathode and anode of a common diode.</li> <li>Draw a stand diode V-I curve, identifying forward and reverse bias regions.</li> </ul>

3. Demonstrate an understanding and working knowledge of BJT biasing circuits, positive and negative feedback, circuits stability, and frequency response.*	<ul style="list-style-type: none"> <li>• Contrast the difference in operation of a differential amplifier with differential and common mode inputs.</li> <li>• Explain and calculate the thermal stability of a BJT amplifier with regards to voltage and power gain.</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate the Q-point of operation for transistors under voltage divider, emitter, and collector feedback bias configurations</li> <li>• Demonstrate, experimentally, signal clipping due to saturation in a BJT amplifier circuit.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the ability to calculate all terminal voltages and currents for a BJT under collector and base DC bias.</li> <li>• Demonstrate, experimentally, BJT switching circuits to form basic logic gates.</li> <li>• Draw the fundamental collector characteristic curves, identifying the load line and regions of operation.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the emitter, collector, and base regions of a BJT on a schematic.</li> <li>• Describe the basic regions of operation of BJT devices - saturation, linear, and cutoff.</li> <li>• Demonstrate the ability to identify the base, collector, and emitter regions with a multimeter.</li> </ul>
4. Design and build BJT amplifier circuits, including multi-stage and power amplifier circuits to meet specifications.*	<ul style="list-style-type: none"> <li>• Design a multistage, Class A amplifier that can drive an 8 Ohm load with a given power gain.</li> <li>• Construct and analyze a Class AB push-pull amplifier, including direct measurement of the input resistance.</li> </ul>	<ul style="list-style-type: none"> <li>• Build and test a multi-stage CE-CC amplifier and demonstrate the effect of loading on voltage gain.</li> <li>• Calculate the voltage and current gain through a Darlington and Sziklai pair.</li> <li>• Describe the operation of a Class AB push-pull amplifier and how crossover distortion is eliminated.</li> </ul>	<ul style="list-style-type: none"> <li>• Analyze CE and CC amplifier configuration under both AC and DC operation.</li> <li>• Experimentally test CE amplifier configurations utilizing bypass capacitors and swamping resistors.</li> <li>• Describe the importance of impedance matching on voltage gain.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the architecture of basic common-emitter and common-collector amplifier circuits.</li> <li>• Interpret device data sheets for all AC and DC <math>h</math> and <math>r</math> parameters.</li> </ul>
5. Demonstrate an understanding of oscillators, voltage	<ul style="list-style-type: none"> <li>• Calculate the resonant frequency of a Wien-bridge oscillator.</li> </ul>	<ul style="list-style-type: none"> <li>• Build and analyze a rectified and filtered power supply, directly</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate the output voltage and PIV for both the bridge and center-tapped rectifier circuits.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the key differences between half-wave and full-wave rectifying architectures.</li> </ul>

regulators, and power supplies.*	<ul style="list-style-type: none"> <li>Construct and analyze a three stage phase-shift oscillator, and demonstrate the frequency dependence of the output.</li> </ul>	<p>measuring dc offset and ripple voltage.</p> <ul style="list-style-type: none"> <li>Calculate the dc offset and ripple factor for a filtered power supply.</li> </ul>	<ul style="list-style-type: none"> <li>Calculate percentage line and load regulation given input and output parameters.</li> <li>Measure the full and center-tapped secondary voltage of a step-down transformer.</li> </ul>	<ul style="list-style-type: none"> <li>Define the key circuit components that comprise a basic power supply.</li> </ul>
6. Demonstrate an understanding and working knowledge of Op-Amps. Design and build Op-Amp circuits for various applications.*	<ul style="list-style-type: none"> <li>Utilize a comparator circuit in an applied circuit such as a temperature sensor or light level sensor.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the operation of an op amp comparator circuit utilizing high and low trigger points.</li> <li>Construct and analyze an op-amp comparator circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Calculate the voltage amplification of fundamental inverting and non-inverting op amps.</li> <li>Construct and analyze inverting and non-inverting amplifiers, including the measurement of input impedance.</li> </ul>	<ul style="list-style-type: none"> <li>Identify the key inputs and outputs on a schematic of a typical 741 op amp.</li> <li>Define open-loop and closed-loop gain.</li> </ul>
7. Demonstrate an understanding and working knowledge of field effect transistors (FETs), JFET and MOSFET circuits and applications.*	<ul style="list-style-type: none"> <li>Construct and analyze a common source E-MOSFET amplifier circuit with respect to voltage gain and loading effects.</li> <li>Build a two-stage, JFET cascode amplifier and analyze the circuit for frequency stability and input impedance.</li> </ul>	<ul style="list-style-type: none"> <li>Determine the JFET terminal and junction voltages for self- and voltage divider bias configurations.</li> <li>Construct and analyze the voltage gain of a common-source JFET amplifier with direct measurement of input impedance.</li> </ul>	<ul style="list-style-type: none"> <li>Draw the JFET characteristic curves for various values of <math>V_{GS}</math>.</li> <li>Identify key differences between the operation of D-MOSFET and E-MOSFET structures.</li> <li>Utilize the JFET in switching circuits to create standard logic gates.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the key differences between bipolar junction architectures and field effect architectures.</li> <li>Identify the schematic symbols of JFET and MOSFET devices.</li> <li>Demonstrate the ability to identify the drain, gate, and source with a multimeter.</li> </ul>

